CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Mark A. Amash

Project Number
S2001

Project Title
Can Cotton Replace Soil for Plant Growth?

Abstract

Objectives/Goals
Would plants be able to grow if their primary nutrient source, soil, is replaced with cotton? If so, would cotton be better or worse for the plant?

Methods/Materials
For my materials, I used soil, cotton, lentil beans, black beans, garbanzo beans, red kidney beans, pinto beans, water, 5 pots, 5 saucer plates, and a metric ruler. I first went to purchase my supplies. Next, I labeled all the pots and saucer pans. I planted six seeds of each plant in five different labeled pots according to the label. I planted six seeds of each plant in the cotton as well (for each of the five plants in the appropriate saucer pans). After i finished planting them, I watered each of the 10 total plants and each day I would measure their height (cm), the number of plants that grew, and the number of leaves that sprouted.

Results
Each plant that was grown in cotton had delayed growth and productivity. The plants in soil showed normal, healthy plant growth. The lentils in the cotton were the only plants that were growing as normaly as though they were grown in normal potting soil. However, all the other four plants grown in cotton were shorter, had less leaves, and less plants sprouted over the same period of time. As the plants grew taller, the beans in the cotton began to fall to the ground earlier than the five corresponding plants in the soil.

Conclusions/Discussion
Cotton retains some similar properties as soil does. Even though soil is better, I can conclude that cotton has the ability to support plant life. Each plant in the cotton grew, the growth and production was just delayed. Cotton has cellulose, water, phosphorous, calcium, and other proteins and organic matter that is required for plant growth. For this reason, plants were able to survive in the cotton environment. Based on the data, the taller the plants grew, the more they fell to the ground in the cotton. The fact behind this is that cotton is less dense than soil so soil has the strength to hold up a plant.

Summary Statement
I tested to see whether plants will be able to survive and grow successfully if they are grown in cotton rather than in soil.

Help Received
Mother helped take pictures of me doing the project.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Claire Barnes; Nettie Mitchell-Brudnick; Brittany Whitehill

Project Number

S2002

Project Title

Sudden Oak Death

Abstract

Objectives/Goals

The objective of our project is to determine if abiotic factors at different altitudes affect the concentration of Phytophthora ramorum by monitoring abiotic factors and the progression of Sudden Oak Death. We want to know if the variation in abiotic factors at different altitudes affects the spread or concentration of Phytophthora ramorum. We hypothesize that at lower altitudes, there will be higher soil moisture, and therefore higher chance of Sudden Oak Death infection.

Methods/Materials

Our project requires a Vernier Lab Quest, soil moisture sensor, light sensor, relative humidity sensor, GPS, and stadia rod. To collect data, we plug in the sensors into the Lab Quest. We then collect data from the centers of our sub plots by inserting the soil moisture sensor into the ground, holding the Relative humidity and Light sensors so that the Light sensor is vertical, and recording the readings given. Using this data, we will try to ascertain any correlation between these abiotic factors and the progression of Sudden Oak Death.

Results

Our data do not show any strong correlations between the abiotic factors of soil moisture, illumination, relative humidity, or altitude against the percentage of infected trees in our plot.

Conclusions/Discussion

We have concluded that our data is not yet numerous enough to show any concrete correlation. We plan to continue monitoring and we think that with more data, we will find a more concrete correlation to exhibit the impact of abiotic factors on the concentration of Phytophthora ramorum. We would like to thank Michael Loik, Jane Orbuch, and Vernier.

Summary Statement

Our project was to monitor the effects of abiotic factors on the concentration of Sudden Oak Death.

Help Received

Prof. Michael Loik of UCSC helped identify trees displaying clear symptoms of Phytophthora ramorum infection.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Dawson J. Bean

Project Number
S2003

Project Title
Creeping Charlie

Abstract

Objectives/Goals
For my project I wanted to find out which kind of fertilizer would promote the most growth for a plant cutting.

Methods/Materials
Materials: 20 Creeping Charlie cuttings, 20 pots, potting soil, ash, fertilizer 5-7-3, fertilizer 22-5-8, and water. My steps were I mixed the four different kinds of fertilizer separately into the potting soil. I filled the pots accordingly with the mixed soil and planted a creeping Charlie. Label each pot according to their fertilizer. Check and record data once a week.

Results
The group of plants that had ash grew an average of 2.24". The group of 5-7-3 grew an average of .76". The group of 22-5-8 grew an average of .17". The group of plain potting soil grew an average of 4.22".

Conclusions/Discussion
Clearly the group with just potting soil grew the most. My conclusion is that it is wisest to use just potting soil when trying to grow creeping Charlie cuttings. This is so because the nitrates and other elements in fertilizer hindered the growth of the cutting. Most people will add these kinds of fertilizer later on in the growth process. The higher nitrate fertilizers seemed to take away the energy of the plant cutting. This experiment will help people understand the effects of fertilizer and how to best use them.

Summary Statement
For my project I tested to see which kind of fertilizer will promote the most growth in a Creeping Charlie cutting.

Help Received
My father helped me plant some of the cuttings.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Zachary D. Blanks

Project Number
S2004

Project Title
To Soak or Not To Soak? An Impact Study of Liquids on Basil Seed Germination

Abstract

Objectives/Goals
If basil seeds are pre-soaked in isopropyl alcohol, hydrogen peroxide, orange juice, or water prior to planting, then there will be an impact on the germination rate.

Methods/Materials
4 liquids were chosen for various chemical properties and known plant effects. Basil seeds were chosen due to quick germination time. Organic soil and peat pots were also selected to grow the basil seeds. Ten seeds were pre-soaked in ¼ cup of each liquid. Seeds were planted in the peat pots and exposed to 24 hours of daylight. Plants were watered with 1/8 cup of tap water each day. The peat pots were placed in a plastic container with a plastic sheet over the top to retain moisture and heat.

Results
During the control tests, the goal was to see how quickly and how many of the basil seeds would grow without pre-soaking the seeds. The first control test was a failure due to the fact that the seeds were only exposed to 8 hrs of light and had no terrarium. However, during the 2nd control test when the seeds had 24 hours of light per day and had the terrarium, all of the plants germinated on the 5th day; and at the end of the 8th day, the peat pot with the most had 8 of the 10 seeds germinating. 3 separate experimental trials were conducted with 10 seeds soaked in each of the 4 liquids. The 1st trial resulted in germination of all the peat pots except the isopropyl alcohol pot. The seeds that were soaked in the orange juice germinated on the fifth day. H_2O_2 was the most successful with 100% of the seeds sprouting. H_2O showed 9 of 10 seeds germinating and OJ had 60% growth success. The 2nd trial also resulted in germination, yet there was reason to believe the signs in the peat pots were mixed up as there was no germination noted in the pot labeled H_2O. The other 3 peat pots germinated in rates and yields similar to the 1st trial. As a result, the data from the 2nd trial is believed to be corrupted and was not used. A 3rd trial was conducted, but germination did not occur prior to project timelines.

Conclusions/Discussion
In general, the data supports the hypothesis. The results show H_2O_2 sped up the germination rate by 20% and germinated 2 more seeds than the control test data. All of the liquids impacted the germination rate of the plants. This data can be useful when trying to determine how to increase the germination rate of not only basil seeds, but possibly other seeds as well.

Summary Statement
To see if basil seed germination rate and yield could be increased by pre-soaking basil seeds in hydrogen peroxide, water, isopropyl alcohol, and orange juice.

Help Received
Mother helped glue board and edit report; Father helped glue board and edit report.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Caroline A. Frost

Project Number
S2005

Project Title
Reducing Pollution through Green Roofs: A Photosynthetic Optimization Study

Abstract

Objectives/Goals
My project has the objective of optimizing the design of green roofs in Southern California by analyzing the storage of carbon by four native plants.

Methods/Materials
Five samples of the following four plant species, fragaria californica, galvezia speciosa, heteromeles argutifolia, and salvia clevelandii, were studied. I measured and recorded the photosynthetic and transpiration rate for the 20 plants using LI-COR equipment, located in the Lab of Professor Philippa Drennan, Chair of the Biology Department at LMU. Each experiment started with adjusting for changes in atmospheric pressure relative humidity and zeroing the equipment. Temperature was held constant as was the air flow. Both rates were measured at 10 illumination levels from 0 to 1800 uMoles m-2 s-1, "Units". Measurements started after a "stabilizing" period and the LI-COR took many measurements and displayed the average of those readings for each illumination level. I averaged and graphed the results from the 5 samples of each species.

Results
Galvezia had the highest Water Use Efficiency Ratio of 7 overall occurring between illumination levels of 400 and 600 Units. At 1200 to 1800 its Water Use Efficiency ratio dropped only to 6, compared to 4 for the other species. Fragaria had the highest photosynthetic rate at 8.9 CO2 Units and saturated at an illumination level of 900 Units. Salvia had the next highest photosynthetic rate of 7.8 (saturation occurring at 1500); galvezia 6.4 (400); and heteromeles a surprising 1.7 CO2 Units, saturating at 200. Heteromeles had the lowest transpiration rate at all illumination levels. Fragaria had the highest transpiration rate at all illumination levels.

Conclusions/Discussion
Galvezia is a superior choice for the vegetation of a green roof in southern California, since its Water Use Efficiency Ratio Maximum is 7 and is greater than 6 for illumination levels over 200 Units. Fragaria had the highest photosynthetic rate but this was offset by the largest transpiration rate. Salvia had the second highest photosynthetic rate but it had the second highest transpiration rate, too, so its Maximum Efficiency Ratio was 4.5. Heteromeles had the lowest photosynthetic rate and transpiration rate at all illumination levels.
Future research should include mapping photosynthetic and transpiration rates and saturation points for increases in CO2 concentration and temperature.

Summary Statement
Optimizing the choice of vegetation for a Green Roof located in Southern California

Help Received
Dr. P. Drennan gave me access to her lab at LMU and explained how to operate the LI-COR. Selected for the SC Academy of Sciences Junior Research Program.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Christina E. Gerges

Project Number
S2006

Project Title
A Newly Discovered Species: A Study of the Basalt Dependency of the Brodiaea santarosae

Abstract

Objectives/Goals
Around 5 million years ago, long after the spread of basaltic magma over the southern California region, the Brodiaea Santarosae came into play. Despite it's long existence, the Brodiaea Santarosae was not discovered until 2006 by Kay Madore, Tom Chester, and Wayne Armstrong. Many botanists predict that the majority of newly discovered species will be discovered to flourish best on soils that are considered strange and are in remote places such as southern California. In accordance with this speculation, this lily like flower seemed to the discoverers to grow only on basaltic soils. The purpose of this project is to verify their assumption that the Brodiaea Santarosae only grows on basalt.

Methods/Materials
In order to visit the Santa Rosa Plateau it is necessary to apply for and receive a researcher's pass. Familiarize yourself with the park and its history during the first visit. Next, inspect the area for specimen of the Brodiaea Santarosae and place flags near them. Select areas in which soil samples will be taken. Throughout the next visit, collect 24 soil samples including one from each area in which a flower grew. Go to a soil chemistry lab and after sifting the soils conduct soil tests including texture, bulk density, moisture content, pH, electric conductivity, and mineral content.

Results
The results show that the locations in which flowers were found generally contained high amounts of iron and magnesium, which are the markings of basaltic soils. Despite this, over half of the specimens were found on felsic soils. Also, the basaltic soil had a generally higher bulk density than that of the felsic. Most physical attributes are similar in both mafic and felsic soils.

Conclusions/Discussion
The Brodiaea specimens that were found on felsic soils were actually in a drainage ditch. Throughout every rainstorm that has occurred in the past 5 millions of years, basaltic minerals have been flowing down into felsic soils, elevating the amounts of minerals vital to the Brodiaea Santarosae. The higher bulk densities of the mafic soils result in hindered root penetration, which means that the likelihood of healthy Brodiaea Santarosae specimens growing is greater in the drainage ditch. The hypothesis was proven correct because, as predicted, the Brodiaea Santarosae only grew in soils that contained basaltic minerals. This proves that the Brodiaea Santarosae is dependent on the minerals contained in mafic soil.

Summary Statement
The purpose of this project is to verify the discoverer's assumption that the Brodiaea Santarosae flourishes only on basaltic soil by conducting multiple soil tests and analyses.

Help Received
Worked in Dr. Chris Amrhein's lab; Worked in lab with 2 other high school students

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Eda M. Graham

Project Number
S2007

Project Title
Gray Water: Saving Our Wetlands, Our Watershed, and Our World

Abstract

Objectives/Goals
To prove that gray water does not harm plants and is safe for home use in landscape and vegetable gardens. To open people's eyes to gray water as a solution to California's water shortage.

Methods/Materials
Use two types of gray water with one natural laundry detergent, one conventional laundry detergent, and a control of tap water to water cabbage plants, broccoli plants, and radish seeds. I measured the growth of the plants and observed the plants' responses to the different types of gray water. I compared the overall results.

Results
I had two sets of results so far because I had two periods of measured growth. In the first period for the cabbage plants, the conventional detergent grew more and in the second period, the natural detergent grew more. I had the same opposite results for the broccoli plants however in the first period, it was the natural detergent that grew more and in the second period, the convetional detergent grew more. In the first period the seeds didn't produce valid results, so I honed in on one plant for the second period: the radish. I found that the conventional degergent grew the most but the leaves of the sprout watered with the natural detergent had bigger, fuller, and greener leaves. The natural one was also more resistant to intense sun rays.

Conclusions/Discussion
I found that neither the conventional detergent nor the green detergent affected the plants growth much. However, compared to the tap water, which had a steady growth, the detergents caused the plants to have enormous growth spurts. The chemicals and nitrates in the detergents didn't seem to have an effect on the overall look of the plant. Anyone can use gray water simply by collecting water from the washing machine before the water drains in a bucked and water their plants. Slums in third world countries could also water their plants with the abundant gray water in the U.S. Also, farmers could use gray water to water their fields. There could be water recycling places where people are paid money to recycle their water. This would open up new jobs as well as help save fresh water.

Summary Statement
To demonstrate that gray water does not negatively affect plants.

Help Received
Mother/Father were the financial support and gave good advice, Mrs. Reynosa helped organize the project with me

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Brian Hie; Vivek Vishwanath

Project Number

S2008

Project Title

Biochar: A Viable Method for Soil Improvement, Water Conservation, and Carbon Sequestration

Abstract

Objectives/Goals

The objective of this experiment was to determine the effect of biochar additives on plant growth, soil water retention, soil bulk density, and soil pH when mixed in varying concentrations.

Methods/Materials

Soils with varying concentrations of biochar were tested for impact on plant growth over a period of six weeks. The control group contained only nutrient poor sandy loam. The experimental groups consisted of charcoal mixed thoroughly into the soil in amounts of 5%, 10%, 25%, 50%, 75%, and 100% by mass. Nine sugar pea plants were planted in soil test group and measured for height and leaves over three, six-week trial periods. The plants were assessed for health by a biomass test. The soils were then analyzed for bulk density, water retention capability, and pH. These tests served as quantitative measures of soil improvement.

Results

Overall, a definitive pattern of plant growth emerged that correlated to the amount of charcoal in the soil. Plants grown in soils with charcoal grew at times 90% better than the plants grown in the control soil. Soils with higher concentrations of bone charcoal did not allow plants to germinate, however. On average, plants in the 25%, 50%, and 75% oak charcoal soils grew faster and larger. In the bone charcoal group, plants in the 5% and 10% soils were the fastest growing. Charcoal also proved to increase water retention capacity greatly, in one instance by 95% in 75% charcoal mixtures. Biochar also improved pH levels and reduced bulk density.

Conclusions/Discussion

The results indicate that charcoal had a profound impact on soil improvement. Biochar improved soil bulk density, water retention, and pH, which in turn would positively impact plant growth. Practical agricultural applications include a natural fertilizer, increased water retention and thus less water usage to grow crops, and a possible application in carbon sequestration fields. In the future, the experiment will test a larger diversity of plants, large scale application, and the possibility of creating a cycle of carbon sequestration.

Summary Statement

The experiment tested the ability of biochar to stimulate plant growth while improving soil quality observed through quantitative measures such as bulk density, water retention, and pH levels.

Help Received

Mrs. Elaine Gillum and Mrs. Erin Schumacher provided insight, gave support, and proof read work; Dr, David Laird narrowed scope of research; parents allowed experiment to be conducted on their property.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Codi L. Hirsch

Project Number
S2009

Project Title
Natural v. Artificial: Photosynthetic Comparisons on Multiple Plant Species

Abstract

Objectives/Goals
My goal was to discover the effects of artificial v. natural sunlight on the photosynthetic rates of a fruit, a vegetable, a flower, and a succulent in closed, controlled ecosystems.

Methods/Materials
12 each one-gallon plastic containers, super soil, water, 3 equally sized: strawberry rootings, potato eyes, daffodil bulbs, and mini jade rootings; 12 each 1/2" PVC ball valves, 12 each 1/2" PVC male adapters with nuts, a rectangular insulated enclosure that is 28 in. x 28 in. x 36 in. with a removable door, 450 LED blue and red light assembly, a temperature sensor, Vernier Logger Pro 3 downloadable software, Vernier carbon dioxide gas sensor, Vernier Oxygen gas sensor.

Results
Natural light was more beneficial to the plants than the artificial light.

Conclusions/Discussion
Natural sunlight is more efficient in aiding the process of photosynthesis than artificial light. Strawberry plants had the fastest photosynthetic rates, followed by the potatoes, the daffodils, and then the succulents. This I believe was due to the plants' size and mass, number of leaves, and state of health. I was suprised to see that the levels of carbon dioxide were relatively high in the exosystems. I believe this could be because of the continer's size and the ratio of water, soil, and plant size in the environment. There was a relative movement between the differences in the two gases, which allowed me to make an approximate conclusion.

Summary Statement
My project is about the effects of artificial and natural sunlight on the photosynthetic rates of various plants in controlled ecosystems.

Help Received
Father helped build the controlled ecosystems

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Chunning (Ningning) Hu

Project Number
S2010

Project Title
CO(2): A Green Thumb?

Abstract

Objectives/Goals
The purpose of my project was to test how an increase concentration of carbon dioxide, evident in our atmosphere over the years, would affect a plant's growth, appearance, and amount of intake and output of carbon dioxide.

Methods/Materials
Pea plants and soybean plants were grown hydroponically in vases with different concentrations of CO(2). Two enclosed vases grew plants at different concentrations of elevated CO(2) while two other vases grew plants in normal concentration of CO(2) in both enclosed and not enclosed vases. Lastly, one vase was enclosed with normal CO(2) concentration but not given any seeds. Their growths, appearances, and CO(2) concentrations were measured over a period of 13 days. In order to mimic outdoor conditions of constant air circulation, the concentration of CO(2) in each container was restarted everyday at their specify concentration. I used a CO(2) Gas Sensor, and I used my breath as a source of CO(2).

Results
My experimental results showed that the soybean plants grew taller and healthier overall in elevated CO(2) than ambient air, while the likewise conditions did not affect pea plants. As for elevated CO(2) having an affect on the amount of CO(2) exchanged between photosynthesis and respiration, the data does suggest that plants grown in elevated CO(2) could decrease the amount of CO(2) released back into the atmosphere during respiration. However, uncontrolled variables were discovered after wards that left the claim indefinite.

Conclusions/Discussion
The majority of plants use CO(2) in photosynthesis, so increasing the concentration has been known to boost the plants' growth. My hypothesis that CO(2) would induce positive growth on both plants was only partially supported. The results showed that pea plants were not affected which could lead to further conclusion that not all plants respond to elevated CO(2). In addition, the amount of CO(2) released back into the atmosphere exhibited a decrease under elevated CO(2). Uncontrolled variables like decomposition, and respiration of microorganisms in the water discovered after wards, may have had an impact. This project suggested that some plants can tolerate the gradual increase of CO(2) in our atmosphere and may even benefit from it.

Summary Statement
My project tests the effect of elevated CO(2) on a plant's growth, appearance, and intake and output of CO(2) during photosynthesis and respiration.

Help Received
Mother and Father helped me obtain materials; Biolodgy teacher Mrs. Kelly lend me equipment and reviewed my work; Uncle got me familiarized with equipment.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Christian Jacobe

Project Number
S2011

Project Title
Fire: Germination of Chaparral Seeds

Abstract

Objectives/Goals
The purpose of my science project is to determine if chaparral seeds can germinate after a fire. Chaparral consists of bushes and shrubs adapted to arid Mediterranean Climates which is hot and dry (about 15 inches per year). Chaparral plants are susceptible to fire because they are oily and have dry branches and leaves. As I researched, I was very interested in finding out if chaparral seeds can germinate after a fire. I tested different chaparral seeds including: Poppy seeds, Catanache Blue, and different kinds of Rhamnaceae seeds (Buckthorn Family) and Ceanothus seeds (Ceanothus Spinosus, Ceanothus Crassifulius, Ceanothus Megacarpus, Rhamnus Ilicifolia, and Rhamnus Californica).

Methods/Materials
1. Mass out 5 grams of crushed dry leaves. 2. Put 30 seeds and the crushed dry leaves in a medium-sized inflammable container. 3. Use matches to light the fire and burn the leaves and seeds. 4. Take out only the scarred seeds and place them in 3 small containers with a soaked paper towel and 10 in each container. 5. Place the containers where there is no light, particularly inside a drawer. 6. Examine and measure the seed's radicle and root hairs during the week. 7. Record data every day.

Results
Name of seed Germinated control Fire Scarred(without soil) Fire Scarred(soil)
Poppy seeds 8/10 9/10 9/10
Catanache Blue seeds 4/10 7/10 8/10
Ceanothus Spinosus 2/10 5/10 7/10
Ceanothus Crassifulius 3/10 6/10 5/10
Ceanothus Megacarpus 1/10 5/10 6/10
Rhamnus Ilicifolia 2/10 3/10 5/10
Rhamnus Californica 3/10 4/10 3/10

Conclusions/Discussion
My hypothesis was correct because the obligate seeders (Ceanothus and Rhamnus seeds) germinated more effectively after fire scarring of their seeds compared to the control groups.

Summary Statement
My project is about fire increasing the rate of seed germination on chaparral seeds.

Help Received
Parents bought display board; My Biology teacher, Mr. Callaway for guiding me on my project.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Calla E. Lipscomb

Project Number
S2012

Project Title
Growing Pains: A Study of the Effect of Pot Size on Plant Growth

Abstract

Objectives/Goals
The objective is to determine if plants grow taller in larger sized pots.

Methods/Materials
72 bean seeds were planted in 24 pots of varying sizes (8, 6, 4 and 3 inches). Six pots of each of the four sizes were used to ensure a sufficient amount of data would be available for analysis. Three seeds were planted in each pot to ensure that every pot had a seed sprout. If more than one seed germinated per pot, the pot was thinned to only one sprout. The bean plants were watered on a daily basis, with equal amounts of water relative to pot size. The pots were placed on four separate trays and were kept under a fluorescent light at all times. Once a day, the trays were rotated one quarter turn around the table so that each tray would face a window and receive the same amount of natural light. Once the plants had been given around three weeks to grow, the heights were measured and recorded. For the next six weeks, each plant's height was measured and recorded on a weekly basis. Once the plants had reached a certain height, the stems had to be tied to dowels in order to ensure straight growth. After the final heights were measured and recorded, the statistical analysis was accomplished.

Results
The tallest plant came from a 6 inch pot. In terms of overall height average, 6 inch pots were the tallest with an average height of 41.6 centimeters. 8 inch pots had the second highest average at 37.3 centimeters, followed by 4 inch pots at 37.2 centimeters. The 3 inch pots had the shortest average height at 33.4 centimeters. Once these averages had been calculated, a comparison between all pot size averages using the t-test was made. Based on calculated t-statistics, the only two pot comparisons that were statistically different were the 6 inch vs. 4 inch and the 6 inch vs. 3 inch.

Conclusions/Discussion
Overall, the data did not support the hypothesis. The results indicate that the tallest plants did not come from the largest pots, but from a smaller sized pot. However, the data did show that the smallest plants came from the smallest pots. Furthermore, the statistical difference between the largest pots and the pots that yielded the tallest plants was not significant. Although the data analysis does not support the hypothesis, there appears to be some relationship between pot size and plant height.

Summary Statement
This project is about the impact of pot size on plant growth.

Help Received
Parents assisted with project layout; Father assisted with statistical analysis

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Nicole Midani

Project Number
S2013

Project Title
An Analysis of Six Plant Species Capacity for Oxygen Production and Ability to Block out UV Radiation

Abstract

Objectives/Goals
Test six distinct species of plant leaf, Plumeria, Jasminum, Hibiscus, S. romanzoffiana, C. limon, and, S. oleracea each with different characteristics on their ability to produce high levels of oxygen, and compare it to the species ability to effectively block ultraviolet (UV) radiation. In this way, information was gathered to provide evidence towards the most beneficial plant specimen(s) to help add oxygen into the atmosphere, and block out dangerous ultraviolet (UV) radiation from the sun.

Methods/Materials
Plant leaves were cut into 2.5cm by 2.5cm pieces. Under full sun, a UV detector was used to measure the strength of UV radiation, first, without the plant leaf as a shield, then the UV strength was then measured under the plant leaf. This measurement was taken three times under the five different leaves of each plant specimen. Two different leaves were then taken from each plant specimen, fixed in glutaraldehyde, then shaken in EDTA. After dissociation process was complete, the samples were smeared on slides, and photographed under 60x magnification. Number of chloroplasts were counted by cellular sampling, unit area sampling, and distinct cell sampling.

Results
When tested, for their ability to block out UV radiation, all of the specimens, Plumeria, Jasminum, Hibiscus, S. romanzoffiana, and C. limon, blocked 100% of the UV radiation they encountered in the test area. S. oleracea, had the most chloroplasts by cellular sampling, unit area sampling, and distinct cell sampling.

Conclusions/Discussion
S. oleracea blocked out 100% of the UV radiation that it encountered, and had the highest oxygen production rate of any species. The data gathered in this experiment suggests that the climate zone the species is in, along with its position in the ecosystem, affects the species ability to block out UV radiation and produce oxygen.

Summary Statement
A natural way to deal with enviromental problems such as UV radiation and decreased oxygen levels.

Help Received
Lab equipment at UCI under the supervision of Dr. Aileen Anderson.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Kelly Ngo

Project Number
S2014

Project Title
Acid Rain's Effect on Beans

Abstract

Objectives/Goals
How does acid rain affect bean plants? Bean plants are vital to humans in the fact that they create oxygen, if acid rain kills these plants there would be fewer oxygen in the atmospheres. So then I wonder, if acid rain kills bean plants, would it also kill other plants and trees? If acid rain kills plants and trees, then it will add to the green house effect. This is what we do not want to happen. So is it really true that acid rain kills bean plants? Once this issues is discover, scientist can determine a way to prevent the amount of acid rain a plant gets, or even better stop plants from getting acid rain. The fewer acid rains a plant gets it will help the plants say alive.

Methods/Materials
16 - 9 oz plastic cups; 4 # Empty 16 oz water bottles; Vinegar & tap water; Napkins; PH Meter; Pipette; Ruler; Pencil; Color pencil; 40 Peruano Beans; 40 Garbanzo Beans; 40 Pinto Beans; 40 Black Loose Beans.

Results
Acid rain will delay the sprouting of beans. The lower the PH of liquid, the chance for a bean to sprout will be less compare to tap water. As a result, the beans being watered with tap water will sprout more.

Conclusions/Discussion
The more acidic a liquid is, the less the beans will sprout; a bean in tap water will sprout more. The results of the experiment generally supported my hypothesis. From the data I have collected, the height of the beans show that the beans being water with tap water, grew taller than the ones being watered with acidic rain. The average estimated height for PH 2.95 is 2.875 inches, PH 4.02 is 2.875 inches, PH 5.18 is 3.0625 inches, and PH 7.45 is 3.4375 inches. The lower the PH the more deadly the plant was with more fungi. The results also tell me that in some rare cases, the bean will do better in acidic rain, like the Peruano bean. If I were to conduct this experiment a second time, I would try to think of a different way to collect my data because the way I did it was very time consuming. Overall, the conclusion of my experiment went very well.

Summary Statement
What happens to a bean when a liquid is more acidic.

Help Received
Project done by self

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Diane L. Polyakov

Project Number
S2015

Project Title
Effect of Ultraviolet Light on Plant Development and Fruit Production Year 3: The Next Generation

Abstract

Objectives/Goals
To determine if reducing the exposure to UV light on pea plants affects the plants' development, fruit production, rate of germination and fruit production over two generations.

Methods/Materials
Build a habitat for the pea plants using wood and clear plastic. One area of habitat is coated with UV blocking film. Three environments exist for plants to grow: Control, Receiving UV Light, and UV Light Blocked. Five pots grow in each environment, one plant per pot. Measure plants and then after pea pods grow, remove pods and measure weight, number of seeds and length of pods from first generation. Extract seeds from pods. Germinate seeds produced from all plants. Plant germinated seeds so that each environment has five pots (and five plants) from each of the three environments, for a total of 45 second generation plants. Grow second generation plants and then repeat steps for first generation, comparing fruit production over two generations.

Results
The average weight for of the seeds produced from the UV Light Blocked environment was 3.78 grams, produced from the Receiving UV Light environment was 3.18 grams, and produced from the Control environment was 2.87 grams. The average length of the pea pods produced from the UV Light Blocked environment was 6.15 cm, produced from the Receiving UV Light environment was 5.49 cm, and produced from the Control environment was 5.7 cm. The average number of seeds per pea pod produced by from the UV Light Blocked environment was 4.6, from the Receiving UV Light environment was 3.8, and for the Control environment was 3.4. The percentage of seeds that germinated from seeds produced in the UV Light Blocked environment was 87.92%, from seeds produced in the Receiving UV Light environment was 79.20%, and from seeds produced in the Control environment was 83.20%.

Conclusions/Discussion
Reducing the amount of UV light the pea plants received resulted in those plants being more productive when compared to pea plants exposed to full sunlight. The seeds from the pea plants grown in the UV Light Blocked environment germinated at a faster and higher rate. Over two generations, the seeds from the UV Light Blocked environment were not as productive, producing less and smaller fruit and showing signs of disease at an earlier stage of plants' development.

Summary Statement
Analyzing and recording the effect UV Light has on pea plants' fruit production and seed germination over two generations.

Help Received
Father help build structure. Teachers answered endless questions.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Nikhita H. Poole

Project Number
S2016

Project Title
Effects of Electrical Stimulation on the Immediate Growth of Bean Plants

Abstract

Objectives/Goals
The goal of my project was to determine whether electrical stimulation of bean plants could positively affect the plants' growth.

Methods/Materials
Beans were organized into groups of ten according to the various variables which were assigned. A series of experiments was performed, which tested the effects of different variables such as the stage of growth at which the current was passed through the plant, the intensity of the current, the length of application, and the method with which the current was applied. A power supply was used to provide the electricity, and a multimeter was used to measure the current.

Results
Although the electrical 'stimulation' ended up killing some of the plants, the combination of variables that did result in more growth than the control was a continuous voltage of 5 Volts applied to the bean in water (as opposed to with wires) for 7 seconds. The beans in this group grew an average of 15.78 cm, whereas the control group grew an average of only 15.1 cm.

Conclusions/Discussion
These experiments have led me to believe that, when applied correctly, an electrical current can indeed positively influence the growth of bean plants. However, because there are so many different potential variables, there are also many ways in which they can be combined. All the variables interact, and many different combinations still remain to be tested in order to determine the very best one.

Summary Statement
This project was intended to determine if electrical stimulation could serve as an alternate means of inducing plant growth, rather than by chemical means.

Help Received
My father obtained a power supply for me to use, and also helped me to reorganize my data tables so that other people besides me could understand them.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Alexander J. Sercel

Project Number
S2017

Project Title
Study of and New Apparatus for Testing Effect of Environment on the Transpiration Driven Flux of Two Greenhouse Gases

Abstract

Objectives/Goals
This was a two part study. Part 1 investigated the effect of atmospheric CO2 level on plant transpiration. Related effects may be highly relevant to the environment because both CO2 and H2O are greenhouse gases. Part 2 was the development and testing of a new type of apparatus which sought to correct flaws in a commonly used apparatus for observing transpiration.

Methods/Materials
Part 1 started with fabrication of a commonly used apparatus consisting of watertight plastic tubing attached to a plant on one side and a pressure sensor on the other. To measure the influence of CO2 on transpiration rate, I added an airtight enclosure to control atmospheric conditions including different CO2 concentrations, directed air movement with measured temperature and humidity inside the box, and variable applied light levels. The part 2 apparatus was fabricated from glass tubing and flasks to increase and control accumulator volume to enable longer run times at modest pressure differentials.

Results
The lowest CO2 concentration yielded by far the highest transpiration rate, while those in the highest concentration yielded the lowest rates. Increases in light and wind levels were found to increase transpiration. While variability in the plastic tubing had little effect on results, the small accumulator volume of the Ward#s Scientific apparatus limited trials to short durations precluding observations of how transpiration rates fluctuate over time. With the part 2 apparatus, transpiration rate was found to vary widely with a characteristic cycle time of hours suggesting that quantitatively correct transpiration experiments must be run for longer periods.

Conclusions/Discussion
Transpiration may be a negative feedback mechanism related to global climate change. When there is excess CO2 in the environment, the stoma in the leaves are able to transpire less H2O. As water vapor is responsible for the majority of thermal blanketing, less H2O being transpired into the atmosphere from increased CO2 levels may have a cooling effect on the environment. Plant transpiration was found to vary widely over time periods of hours with periods of zero and even negative flow of liquid. Hence, the short duration of the standard AP biology experiment is suspect. In addition, the Ward's experiment uses uncalibrated pressure measurements, with pressure near the plant transpiration pressure as an incorrect surrogate for transpiration rate.

Summary Statement
My project is an investigation of transpiration's impact on climate change as well as a new approach to measuring transpiration in plants that provides unique insights into the interactions of plants and their environments.

Help Received
Father helped with apparatus design, Mother helped with board lay-out

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Sheena W. Song

Project Number
S2018

Project Title
The Effects of Recycled Water on the Growth and Chemical Composition of Eleocharis palustris

Abstract

Objectives/Goals
With the growing demand on a limited water supply, the use of recycled water for irrigation offers both a possible long termm sustainable approach as well as a cost effective plan. However, the effects of recycled water on the growth and chemical composition of plant species are virtually unknown and may therefore pose a risk to the well being of plants. Because rush species are accustomes to growth in environments saturated with nutrients, it was expected that recycled water may potentially benefit plants treated with recycled water.

Methods/Materials
In this experiment, two water treatments were used to evaluate the responses of the rush E. palustris. These treatments included tap water and recycled water. The plants were irrigated regularly and stem counts and height measurements were taken. At the end of an approximately 90 day period, wet and dry masses were obtained. Several analyses were then taken, which included net water absorption and stem: root ratio. Plant tissue samples were sent to a lab and a conclusive plant tissue mineral analysis were conducted.

Results
It was concluded that though recycled water was expected to give the plants a boost with its extra nitrates and phosphates, the excess of heavy metals and salts ultimately proved detrimental to the plants' health, as seen by decreased overall plant growth. Recycled water caused the plants' shoot system to outgrow the roots system, hindering the plants' ability to absorb the necessary nutrients and to support itself. In addition, it was determined that the plants treated with recycled water retained more water than those treated with tap water. Plant tissue tests concluded that those plants treated with recycled water had an unusually high concentration of all minerals except iron and magnesium. This deficiency can be attributed to the excess of potassium, phosphorus, and zinc.

Conclusions/Discussion
The use of recycled water is an important first step in our fight against the world's growing water crisis. However, it is imperative that recycled water be thoroughly evaluated and designated to proper uses.

Summary Statement
This project aims to determine the effects of recycled water on the growth and chemical composition of the rush species, Eleocharis palustris.

Help Received
Mother drove me to greenhouse

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Nicholas Tong

Project Number
S2019

Project Title
Oxygen Generation from Golden Ribbon in Photosynthesis under Different Colored Lights

Abstract

Objectives/Goals
The objective of my project was to determine whether component color lights of the visible light spectrum is more efficient in oxygen generation than the white light in photosynthesis.

Methods/Materials
I built a cylindrical transparent plastic container to hold the golden ribbon aquatic plant (dracaena variegates) and use a 200-watt incandescent light bulb as a light source. Color lights were simulated by using colored cellophane sheets. Oxygen generation was monitored by Pasco Scientific Xplorer GLX instrument with Oxygen Gas Sensor. Sixty experiments were performed in my project. Total time was about 122 hours.

Results
Experimental results confirmed my hypothesis that on the average purple and blue lights, that are shorter in wavelengths and therefore more energetic, did generate more oxygen in the aquatic plant golden ribbon used. White light turned out to be in the middle of the range in oxygen generation followed by red, orange, yellow, and green colored lights.

Conclusions/Discussion
My science project concluded that single color lights like blue and purple lights are more efficient at oxygen generation in photosynthesis. In the process of doing this project I also learned and discovered the concept of photorespiration. When plants are put in confined environment and if not enough carbon dioxide is available, they tend to use oxygen instead of continuing with photosynthesis and give off oxygen.

Summary Statement
My experiment showed that blue and purple color lights with higher energy spectrum helped plants generated more oxygen.

Help Received
My biology teacher, Mrs. Angelina Sill, gave me guidance and reviews on how to do a science project. My dad, David Tong, helped me designed the plastic container. My school principal, Mr. Jerry Romsa, gave me guidance on my display board.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Megumi H. Tso

Project Number
S2020

Project Title
Speedy Sprouts

Abstract

Objectives/Goals
I was trying to determine whether an acidic, basic, or neutral solution would increanse the germination of a Bush bean.

Methods/Materials
I soaked six beans per solution and used a paper towel to wrap them up in.

Results
Drinking water, a netural solution, stimutated the germination the most and the rest of the solutions did best in the following order: hyrdrogen peroxide (acid), potassium hydroxide (base), and hyrdochloric acid (acid).

Conclusions/Discussion
the drinking water did the best while the hydrochloric acid caused the Bush beans not the germinate at all. It destroyed the inside of the beans, making it impossible for the beans to germinate. The potassium hydroxide did not stimulate nor prevent the germination process but still allowed germination to take place and the hydrogen peroxide did the second best of stimulating germination.

Summary Statement
I was trying to determine weather a more acidic, bacis, or neautral solution would increase the germination of a Bush bean.

Help Received
Chemistry teacher helped diluite the solutions

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Marlene I. Uriostegui

Project Number
S2021

Project Title
The Effect of Household Chemicals on Swiss Chard Plants

Abstract

Objectives/Goals
My objective was to learn if watering plants by using household chemicals such as windex, pine-sol, and bleach, would affect the development of the plants as well as their chlorophyll levels.

Methods/Materials
The method that I approached towards doing this experiment was using twelve Swiss Chard plants and I then separated them into groups of four. Each group was watered with a different household chemical and the control group was a group that was watered only with water. Eight trials were taken in total, for a total amount of four weeks. During each trial, the area of the leaves was measured and I used graph paper to do this. During these trials, I also measured the height of each plant. In four of these eight trials, I measured the absorbance level of leaves of each of the plants by using a spectrophotometer. After I found the absorbance level of the leaves I blended, I used the equation of Lichtentaler and Wellburn which helped me find the chlorophyll level in the leaves of the plant that I was testing. After gathering all data, I compared the effects of each plant that was watered with a certain household chemical to all the other plants.

Results
After the eight trials, there was a significant change not only to the appearance of each of the plants but also to the chlorophyll levels within the plants. Out of all the three groups of plants that were being watered with the household chemical, there was not a significant change to the group of plants that was being watered with Windex because Windex contains ammonia.

Conclusions/Discussion
The results and all the data gathered, proved that my hypothesis was correct. The group of plants that had a least effect overall were the group of plants that were watered with Windex. These plants suffered the least because Windex contains ammonia and nitrogen is also found in ammonia. This group of plant didn't have a dramatic loss of chlorophyll as opposed to the other group of plants because, nitrogen is a major component of chlorophyll, the compound by which plants use energy from the sun to produce their own sugars which leads to their production of stems, leaves, and fruits of every plant. This information proves that plants that may be polluted with household chemicals due to the owner's carelessness, will suffer and undergo a dramatic change that may even cause the death of any plant.

Summary Statement
My project was about how certain household chemicals can affect the growth, chlorophyll levels, and leaf development of Swiss Chard plants.

Help Received
Parents helped me gather materials; parents also took me to stores and bought the materials I needed to use; my chemistry teacher allowed me to stay in her class after school in order to use the spectrophotometer

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Brooke D. Wenig

Project Number
S2022

Project Title
The Effect of Temperature on the Sucrose Content of Grapes

Abstract

Objectives/Goals
To see if temperature has an effect on the sugar content of grapes after they are picked.

Methods/Materials
I exposed five different types of grapes to three different temperatures and measured their sugar content using a refractometer on the Brix scale. For this experiment, I needed a refractometer, a thermometer, and 60 of each type of the following grapes: green, red, black, organic green and organic red. I sorted the grapes into the three temperature groups, cut the grape in half, then put the juice from the grape on the inside of the refractometer and closed the lid. I then looked through the refractometer to read the "sugar weight" of the grape and recorded it in a lab notebook to later analyze in excel.

Results
When temperature increases, the sugar content of grapes increases. Conversely, when temperature decreases, the sugar content of grapes decreases.

Conclusions/Discussion
The data support my hypothesis that if gapes are exposed to higher temperatures, then their sucrose levels will increase. This research can be extremely beneficial to diabetics because it could lower the risk of having their blood sugar spike or crash unexpectedly by being able to predict their blood sugar levels by knowing the relative sugar content of their fruit based on temperature. In addition, it can help athletes because before a work-out, they need foods that are lower on the glycemic index to sustain them, and after the work-out they need foods that are higher on the glycemic index to help speed up recovery of their muscles. Both diabetics and athletes can choose which temperature to have their fruit at so they can alter the sugar levels of that fruit to ultimately benefit them.

Summary Statement
How temperature has an effect on the sucrose content of grapes.

Help Received
Father bought refractometer for me.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Yunhao Zhang

Project Number
S2023

Project Title
Striving for Surviving

Abstract

Objectives/Goals
My first goal was to see if Aloe vera can survive in acid and base. Secondly, if they can survive, I will investigate the reasons why and determine if Aloe vera might be used for environmental protection.

Methods/Materials
In phase one, I divided six healthy Aloe vera into three groups and labeled them as acid, base, and neutral. Since the independent variable was the pH of the soil, I watered the acidic group with lemon juice (pH of 2), the alkaline group with soap water (pH of 12), and the neutral group with water (pH of 7). I watered each group with their respective lquid for one month. The control variables were the air supply and the amount of direct sunshine received. In phase two, I took two new Aloe vera leaves into two groups: acid and base. I tested one leaf with a sodiumhydroxide (NaOH) solution (pH of 14) and the other with a hydrochloric (HCl) solution (pH of1), both having concentrations of 1%, to see if Aloe can neutralize the solutions. I dropped ten drops of the NaOH solution into the new base group, and ten drops of HCl solution into the new acid group. My results were based on the color change of pH test paper.

Results
Aloe vera could survive in acid and base; however, compared with the Aloe vera in neutral conditions, Aloe vera in acid and base did get a little damaged. In phase two, the pH test paper for the acid group turned from red to very close to yellow. The pH test paper for the base group changed from dark blue to light blue.

Conclusions/Discussion
Aloe vera can survive in acid and base because its juice and pulp can neutralize both acid and base. In future investigations, I want to see if polluted gas from cars can be neutralized by Aloe vera.

Summary Statement
I water Aloe vera with acid and base to see if they can survive so that I can determine if Aloe vera can be used for neutralizing acidic or alkaline pollution.

Help Received
Mrs.Tarr provided me necessary equipments for chemistry experiments. My cousin helped me embellish my dispaly board.